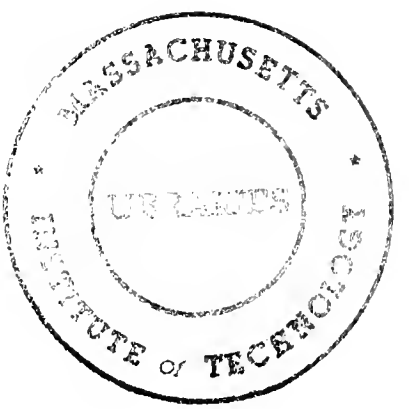
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AGENCY THEORY AND CONTROL STRATEGY: A FIELD STUDY

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ABSTRACT

Using an agency model applied in the context of large corporate organizations, several hypotheses are derived relating monitoring, evaluation and reward strategies to (1) the level of task uncertainty of responsibility centers, (2) the degree of risk and effort tolerance of managers, and (3) the relative cost and feasibility of direct monitoring of managerial behavior. The hypotheses are all based on minimizing agency costs. They were tested using data from a sample of 415 managers in 13 major U.S. companies. All were supported by the empirical results, except for the predictions about effort tolerance. As task uncertainty increases there is less reliance on budgets in evaluating and rewarding performance. Moreover, budgets are modified appropriately: as price uncertainty increases there is a shift from monetary to physical units of measurement in the budget, and as task uncertainty more generally increases the budget period lengthens, and the budget becomes more adaptable to reflect unanticipated changes as they occur. Even after adjusting for task uncertainty, greater budget reliance is used for managers with higher risk tolerance, suggesting a tailoring of incentive contracts to this personal trait of managers. Further, managers' risk tolerance is significantly associated with the level of task uncertainty of their responsibility centers, suggesting an effective mechanism for matching persons to organizational roles. Finally, even after adjusting for differences in task uncertainty, significant differences in control strategy are observed across functional groupings. These differences are consistent with greater cost effectiveness of monitoring managerial behavior for research and development and administrative support functions, and conversely with greater cost effectiveness of monitoring outputs for internal operations, purchasing and sales functions.

AGENCY THEORY AND CONTROL STRATEGY: A FIELD STUDY

Since the seminal papers by Ross (1973) and Jensen and Meckling (1976), agency theory has advanced rapidly to the point where it offers the possibility of providing a theoretical foundation for studying management accounting and control systems in organizations (see, for example, Demski and Feltham, 1978; Holmstrom, 1979; Baiman, 1982). The traditional approach to understanding management control systems has been guided largely by experiential wisdom, incorporating various theoretical perspectives in a rather fragmentary manner (see, for example, Anthony, 1965; Vancil, 1973; Lorange and Scott Morton, 1974; Anthony, Dearden and Bedford, 1984). Another approach to examining management accounting systems as part of organizations' management control systems has been to link management accounting with organization theory, especially with contingency theory. However, Otley (1980) reviewed the accounting research which has proceeded within this theme, and he concludes there is little theoretical cohesion to the work, simply some commonality in perspective and research method.

In this paper an agency framework is used to predict relationships between control strategies and the degree of uncertainty encountered in the managerial task. The predictions are tested, and largely found to be supported, in a field study involving 413 managers in 13 major U.S. corporations. In the next section the hypotheses tested in the field study are derived. It is demonstrated that these are broadly consistent with the normative assertions proposed by the traditional approach to management control system design, with behavioral theory, and with findings from studies conducted in a contingency framework. The field research and measurement of the variables used in the study are then

described, and this is followed by a presentation of the results. A final section summarizes the findings, and discusses avenues for further research suggested by the study.

THEORY AND HYPOTHESES

This section begins with a summary of the main features of agency theory. These are then applied to derive the hypotheses which were tested in the field study. Finally, the hypotheses are reconciled with other literature pertinent to management control system design.

Agency Theory: The economic theory of agency models two persons, a principal, the residual owner of the firm, and an agent, the supplier of effort to the firm's production process. Both are assumed to seek to maximize the personal utility they derive from their relationship with the firm. Four conditions are necessary to make the model interesting: (1) the principal cannot observe with certainty the agent's effort; (2) effort converts into output in a stochastic manner; (3) the agent is effort averse or, stated differently, incurs negative utility by expending effort, and (4) the agent is risk averse or, again stated differently, incurs negative utility by bearing risk. If any of these conditions is not present, the principal need only compensate the agent exactly for the effort supplied. This situation is termed the "first-best solution." It obviously pertains if effort can be perfectly observed; similarly, if the production process is perfectly determinable, then effort can be deduced from output and compensated exactly. If agents were not effort averse, effort would be willingly and costlessly provided to the production process, and no agency problem would exist. Finally, if agents were not risk averse they would be willing to own on their own account the production process, again eliminating the agency problem.

In conditions of uncertainty the agent must inevitably bear some risk. This is so because partial signals of effort may be used to deduce and compensate the effort supplied. Alternatively, output, which is determined by factors other than simply the agent's level of effort, may be measured and used as the basis of an incentive contract. Since the agent is risk averse, the expected mean level of compensation must exceed the pure market rate for effort by a risk premium. At equilibrium the premium will exactly equal the agent's disutility for the riskiness of the situation. This equilibrium is called the "second-best solution;" that is to say, the solution which efficiently compensates the agent for both effort and risk. In this circumstance, the residual accruing to the principal comprises the output of the firm, less the effort and risk compensation to the agent and monitoring costs.

The difference between the first-best and second-best solutions is called the agency cost. Intuitively, it can be appreciated that the agency cost will increase as the uncertainty of the effort-output relationship increases, and as the effort and risk aversion of the agent increase. This is formally demonstrated by means of a simple agency model in Appendix 1.

Hypotheses: The agency model outlined in the previous section is applied here in the context of managers delegated responsibility for the work of defined portions of the overall firm. The manager, then, is the agent, and the organization is the principal. It is proposed that an organization's management control system will be designed in such a way as to minimize agency costs. In point of fact, the study does not examine the whole of the control system, only that portion which is concerned with evaluating and rewarding managerial performance. Nevertheless, this is an important part of

a control system; indeed, some authors have maintained it is its most important feature (e.g. Drucker, 1964).

The focus of the research is on individual managers and their responsibility centers; the context is large U.S. profit-directed corporate organizations. It is assumed that all of these organizations will have in place an accounting system to satisfy fiduciary responsibilities by accumulating an on-going financial record of the organization's cost levels, revenues, profits, assets and equities. The study is concerned with the way the accounting system is modified and used for purposes of managerial control; it interprets this through the managers' perceptions about the way in which their performance is budgeted, monitored, evaluated and rewarded.

The study compares the use of output budget-based incentive contracts with direct monitoring of managerial behavior as alternative control strategies. With regard to the use of budgets, several aspects are considered as follows: the intensity of measurement and the units of measurement incorporated in budgets, the time period covered by the budget and the extent to which alterations can be made to the budget during the operating period to which it refers, the degree to which meeting budget matters in ex-post performance evaluation, the degree to which having produced the best results possible in the circumstances which prevailed during the operating period is disregarded in ex-post performance evaluation, and the extent to which formal rewards - pay increases, bonuses and prospects for promotion - are contingent on meeting budget.

In an overall sense then, a principal feature of the control system which is examined is the degree to which budgets represent inflexible and binding contracts in evaluating and rewarding performance. For convenience, in the remainder of the paper we simply use the term "budget reliance" as a

shorthand to convey the idea, except when it is important to distinguish specific features within the general concept.

Central to most models of managerial control are (1) the ability to discriminate between good and bad performance, (2) the ability to predict the effects of managerial actions in order to select those actions which will steer the responsibility center away from poor and toward good performance, and (3) the discretion to choose and implement the managerial actions considered appropriate as circumstances change (Otley and Berry, 1980). Reduction in any of these - measurability of performance, predictability of outcomes from actions, or managerial discretion - is likely to increase a manager's sense of uncertainty, and to reduce his or her perception of having control over the performance of the responsibility center. This in turn may be interpreted by a manager as being more risky since, lacking any compensating modification to the control system, it will render the effort-reward relationship less specifiable and predictable.

A number of features of the task environment of the responsibility center are incorporated in the study, as follows: the frequency and predictability of interruptions to the responsibility center's work flow, the degree to which its work can be standardized, the degree of operating interdependence of the unit's work with other responsibility centers in the organization, and the frequency and predictability of changes in its operating environment. Higher task uncertainty is interpreted as being associated with less routinized and standardized work, higher operating interdependence, and more rapid and less predictable change in the operating environment.

Finally, two attributes of the mangers are considered as follows: risk tolerance and effort tolerance.

The central question addressed is how the control system can be designed to reduce agency cost. Clearly, altering the degree of budget reliance could be means of doing this. A budget represents a pre-set performance goal. As uncertainty increases, the likelihood of a pre-set goal continuing to be an appropriate standard in the light of actual circumstances must surely diminish. Hence, we should expect less budget reliance in the case of responsibility centers which face greater task uncertainty. In a similar vein, we should expect less budget reliance in the case of managers who have relatively low risk and effort tolerances. These propositions form the first hypothesis of the study:

H_1: Lower budget reliance is expected to be associated with: (a) responsibility centers with greater task uncertainty; (b) managers with lower risk and effort tolerances.

An aspect of the control system nested within this hypothesis concerns the form of measurement incorporated in the budget, in particular distinguishing between physical and financial measures. Additional information should only be used when this clarifies the manager's level of effort. Since we assume the accounting system usually reports performance in financial terms, obtaining and reporting physical measures of performance will require additional design effort and cost; this is more likely to be worthwhile in circumstances where a responsibility center's input and output prices are changing relatively rapidly and unpredictably. This was adopted as the second hypothesis:

H_2: Greater frequency and lower predictability of change in input and output prices are expected to be associated with a greater propensity to use physical, instead of financial, measurements in the budget.

Consider now the issue of assigning managers to roles, where the roles are characterized by different levels of task uncertainty. It would be desirable, from an agency perspective, for managers with relatively high

tolerance for risk and effort to be assigned to roles with relatively high task uncertainty, and vice versa. Clearly, managers are not in practice perfectly substitutable across roles; nor are they necessarily totally obedient to the organization's dictates in these matters. Nevertheless, it is reasonable to assume that some degree of matching will occur, partly through the organization's assignment mechanisms and partly through self-selection of roles by managers. This prediction is the basis of the third hypothesis:

H_3: Managers with greater risk and effort tolerances are expected to be associated with responsibility centers with greater task uncertainty.

The first and second hypotheses suggest a tailoring of the control system to the nature of a responsibility center and its manager, whereas the third hypothesis proposes matching managers to the task uncertainty of responsibility centers. These strategies are not of course mutually exclusive. Thus, an issue arises concerning the causality in H_1. Suppose H_3 holds, so that risk and effort tolerances are positively associated with task uncertainty. Then, in analyzing H_1, even if budget reliance and task uncertainty are negatively associated, an observed positive relationship between managers' risk and effort tolerances on the one hand, and budget reliance on the other may be spuriously low because of H_3's effect. One way of controlling for this is to test the relationship between the risk and effort tolerances of the managers and a measure of budget reliance after adjusting for task uncertainty. This leads to an addendum to H_1 as follows:

H_1' Even after controlling for differences in the task uncertainty of responsibility centers, less budget reliance is expected to be associated with managers with lower risk and effort tolerances.

A third feasible strategy for reducing agency costs is simply to monitor effort, instead of, or perhaps in addition to, output. Direct monitoring of effort will be attractive when its cost is less than the risk premium costs of output-based contracts. It is difficult in practice to measure either of these costs directly. Thus, to explore this theme we resorted to an indirect test using a functional classification of responsibility centers as a proxy for likely variations in the relative feasibility and cost-effectiveness of direct monitoring of effort as compared with output-based contracts. The responsibility centers were grouped into four functional groupings as follows: research and development (R&D); administrative support (AS) including such activities as finance, personnel and the provision of information; and two current operating functions, internal operations, including manufacturing and distribution, and boundary spanning, including purchasing and selling.

Two conditions affecting the most efficient means of control are likely to vary systematically across these functions, namely geographic dispersion of activities and the specificity of the production function which translates effort into outputs. Boundary spanning activities are likely to be conducted in a much more geographically dispersed mode than the activities of the other functions; hence, monitoring of effort is not likely to be feasible, resulting in greater reliance on monitoring of outputs. The production functions for internal operations are likely to be sufficiently specific to allow effort to be deduced from output, especially when output is measured in physical units. Hence, for internal operations, monitoring output is more likely than monitoring effort, and physical rather than financial measures of output are also more likely. R&D and AS, on the other hand, are both likely to be concentrated in one,

or perhaps a few, geographic locations; moreover, in neither case is the production function which translates effort into effective output very specific. Thus, direct monitoring of effort is likely to be more feasible and cost effective in these two functions. These predictions were the subject of the fourth hypothesis:

H_4: Greater budget reliance is expected to be associated with internal operations, purchasing and sales functions than with research and development and administrative support functions.

The preceding hypothesis is based on the argument of the feasibility and relative cost of output-based incentive contracts versus direct monitoring of effort. However, if H_1 holds the hypothesized relationship could result if there happened to be systematic differences in task uncertainty across functions. There is intuitive reason to believe this could be the case. Therefore, task uncertainty should be controlled for in testing the reason for H_4. A supplementary hypothesis to H_4 was therefore adopted, as follows:

H_4': Even after controlling for differences in task uncertainty, greater budget reliance is expected to be associated with internal operations, purchasing and sales functions than with research and development and administrative support functions.

The research framework and the hypotheses of the study are summarized in Figure 1.

INSERT FIGURE 1 ABOUT HERE

Reconciliation with Other Literature: The hypotheses are not inconsistent with various other themes in the literature, for instance the normative approach to management control, organizational psychology, and contingency theory applied to management accounting.

Vancil (1973) identifies two main criteria to guide the design of performance measures to apply to an organization's responsibility centers, goal congruence and fairness. Goal congruence means that if managers act in such a way as to maximize their center's performance as reflected by the control system's measures, they will simultaneously be maximizing individual and collective progress toward the organization's goals. Regarding fairness, Vancil says, "...[a manager] must believe that the measurement encompasses all the factors he can control and excludes those over which he has no control" (page 77). This stress on fairness seems to be justified in terms of sustaining the directive power of the measures, and avoiding negative emotions toward the organization. A similar theme is found in organizational psychology, based on the evidence that holding people accountable for things over which they perceive themselves to have no influence raises stress, with dysfunctional consequences for performance and personal wellbeing. Weick (1983) concludes a review of the literature on stress and stressors with the advice, "As much as possible, people should be given controllable features of a situation." (page 365). Agency theory, of course, does not contradict these points. However, fairness is not achieved solely by filtering out of performance measures the effects of stochastic disturbances arising in the operating environment. For one thing, this could cause inattentiveness to the environment, which is hardly likely to be conducive to goal congruence. And secondly, stress, to a point, may be constructive (Libby, 1983); managers may be different from other people precisely because they are relatively tolerant of the stressful circumstances frequently encountered in managerial work. Agency theory's reconciliation with the norm of fairness is in the notion of efficient compensation. In an efficient

equilibrium a manager will be compensated not only for effort, but also for the disutility, including stress, incurred from coping with uncertainty.

Otley (1980) provides an excellent review and synthesis of the contingency approach to management accounting. He defines this to be based on "...the premise that there is no universally appropriate accounting system which applies equally to all organizations in all circumstances...particular features of an appropriate accounting system will depend upon the specific circumstances in which the organization finds itself" (page 413). One problem, of course, is deciding what are the pertinent contingencies. Empirical studies have identified relationships between control system features and the nature of product-market competition (Khandwalla, 1972, 1973), leadership style (Hopwood, 1974; Otley, 1978), organization size and structure (Bruns and Waterhouse, 1975; Merchant, 1981, 1984), and task complexity and technology (Daft and MacIntosh, 1978; Merchant, 1984). The present study either incorporates, or controls for, all these variables. The nature and degree of competition will be reflected in the measures of task uncertainty. In a condition approximating perfect competition, for example, there is very little uncertainty, whereas in an entrepreneurial situation uncertainty is high since there is little relevant experience to inform managerial judgment. The managerial tasks in most large companies are in some intermediate position between these extremes. But in any event, the competitive situation should be reflected in the perceived environmental uncertainty expressed by the managers and measured by the research instruments. Hopwood's leadership style is included as part of the concept of budget reliance, and the nature of the task and the

work technology are included in the measures of task uncertainty. Finally, organization size is controlled for by having in the sample only managers from very large companies.

Several studies have, like the present study, dealt with uncertainty as the contingent variable. Hirst (1983) found higher reliance on quantitative performance measures (c.f. budget reliance in this study) to be functional in cases of low, and dysfunctional in cases of high, uncertainty. Gordon and Narayanan (1984) found that the type of information considered most valuable by managers varies with differences in perceived environmental uncertainty. Finally, Govindarajan (1984) found that greater use of subjective rather than formula-based methods for awarding managerial bonuses led to higher levels of self-rated performance in conditions of high uncertainty, and vice versa.

Hayes (1977) tested propositions about differences in the sources contributing to managerial effectiveness across functional groupings. While quite different in emphasis from the present study, Hayes' conclusion that monitoring and measurement methods should be tailored to the distinctive characteristics of each function agrees with the spirit of our last two hypotheses.

A recent paper by Eisenhardt (1985) relates organization theory and agency theory in predicting forms of control as a function of task programmability, outcome uncertainty and cost of measuring outcomes; she presents empirical evidence consistent with her predictions. In contrast to the present study, however, Eisenhardt did not consider in her framework the personal traits of managers. One previous study, by Chow (1983), did examine, under experimental conditions, skill level and risk preference, using these as predictors of the choice between

performance-based and fixed compensation schemes. Subjects believing themselves to possess higher levels of skill were found, as expected, to prefer a performance-based reward scheme; but the predicted moderating effect from risk aversion was not found. It is conceivable that the latter result could be explained by a lack of a sense of risk on the part of subjects, since the contingent payments in Chow's experiment were both small and notional regardless of whether the task goal was met.

THE RESEARCH

In this section the main features of the field study are presented. The discussion first describes how the data were collected, and then how each of the variables included in the analysis was measured.

Field Study: A questionnaire was sent to 605 managers in thirteen major U.S. companies. Initial contact with companies was made by a letter to the chief executive, and administration of the research was subsequently coordinated through a senior member of corporate management. Sample selection was done by each company's management. Companies were asked to select a representative sample of their middle-level operating managers. These managers were to be carrying significant functional responsibility, covering only domestic operations, at a level just below general management. Functional variety in the sample, representative of the functional mix in the company, was part of the sample design.

The questionnaire was sent to each manager accompanied by a cover letter signed by one of the company's corporate executives. The letter introduced the study and encouraged participation. A pre-addressed envelope was included for completed questionnaires to be returned directly to the research team. Responses could be identified by company, but not by respondent. This was considered advisable to minimize bias which might

arise if the managers were to believe their responses could be inspected by their corporate managements.

Completed questionnaires were received from 415 managers (a response rate of 69%). The respondents averaged 16 years of experience with their companies, and ten years in their present jobs and jobs similar in responsibility and content to their present jobs.

More data were collected by the questionnaire than were used solely for the study reported in this paper. The questionnaire was pre-tested for clarity of expression and for the time required for its completion using a sample of 20 managers similar in background, experience and level of responsibility to those intended as the subjects of the study. The average time taken in pre-testing to complete the questionnaire was just under 30 minutes.

Most of the questions asked for a response on a seven-point scale, with both ends of the scale being anchored by descriptive captions. In some cases respondents were asked to answer by entering a number in a box, selecting from a numerical scale which was descriptively anchored at the end points and at salient intervening points. Finally, a few questions required a "yes-no" or a brief verbal type of response.

Managers: Research in the area of decision making under conditions of risk is well established; Schoemaker (1980) provides an excellent review of this work and its methodology. Risk preference in this research is usually assessed by means of a series of carefully described lotteries for which subjects are asked to express the certainty equivalents which would render them indifferent to the respective lotteries. However, this methodology is laborious, and runs a risk of lacking contextual validity. Libby and Fishburn (1977) note that measures of risk preference tend to be

sensitive to both situation and task. For this reason, it was decided in the present study simply to ask the subjects to provide a self-rating of two of their personal qualities as managers, their decision-making style and their risk-reward tendency when making management decisions. The terminology of Mintzberg's (1973) work on decision-making style was borrowed for the first question. One end of the scale was anchored by the term "entrepreneurial," described as having a preference for bold, dramatic actions and a relative disregard for risk, while the other end was anchored by the term "adaptive," described as preferring a cautious, one step at a time approach to problem solving, accompanied by a high degree of discussion and consultation with others. The second question was anchored at one end as having a preference for "low risk, and a moderate pay-off with high certainty," and at the other end by, "high risk, and a high pay-off but with an appreciable chance of loss." The responses to these questions were significantly correlated with one another ($r = 0.602$; $p < 0.01$) in the expected direction. Both were used, with their scales reversed, as proxies for the managers' tolerance for risk.

Two sets of questions were used to assess effort tolerance, one set referring to hours spent at work, and the other to the intensity of effort during work hours. Reference was made to the notion of a minimum level of effort acceptable in the organization. Respondents were asked first how much effort, hours and intensity, above this minimum level they usually expended, and then the level of personal cost, or disutility, they attributed to this incremental effort. The first response measured their incremental effort level (say a), and the second measured its marginal disutility (say b). All else equal, the marginal disutility of effort

will increase with an individual's effort aversion parameter, i.e. b tV'(a) where V'(a) is increasing with a, and t is the individual's effort aversion. Hence, t increases with (b-a), both of which were measured. The two estimates of t, one based on hours and the other on intensity of effort, were correlated with one another ($r = 0.626$; $p < 0.01$) in the expected direction. Both were used, with their scales reversed, as measures of the managers' effort tolerance.

Task Environment: Three sources of task uncertainty were considered in the study, namely the work flow of the responsibility center, the interdependence of the responsibility center's work with the work of other organizational units, and the responsibility center's operating environment. These three sources are roughly consistent with the framework used by Hayes (1977) in his study, except that he considered the operating environment to include only the environment external to the firm, whereas we consider the operating environment to include the corporate as well as the external environment.

The questions about work were based on Perrow's (1967) concept of production technology. Three questions were used. The first two dealt with the frequency and predictability of interruptions to the normal work flow, and the third with the degree to which the basic work was well understood and could be reduced to a standard routine. Measurement of work interdependence followed Thompson's (1967) notion of reciprocal interdependence, and included two questions, the first dealing with the unit's degree of dependence on other units of the organization, and the second with the degree of dependence of other units on the unit in question.

Aspects of the operating environment measured by the questionnaire included the volatility and predictability of both input and output prices to the responsibility center, and the dynamism and predictability of change in relevant items other than prices, such as "...technical and legislative factors, policy changes emanating from elsewhere in the organization, and competitor actions." The intent and wording of these six questions were selected and modified from questions used originally by Khandwalla (1973, 1972) in his study.

All eleven of the measured variables are believed to have the potential to contribute to task uncertainty, placing demands on the manager of the responsibility center and increasing the sense of risk in terms of diminishing the clarity of the effort-outcome-reward relationship. The intercorrelations between the eleven variables are shown in Table 1. Some of these are very significant. However, to avoid the interpretation problems which accompany the reduction of variables by factor analysis, and since there are in any case only eleven variables, it was decided to use all of them in the data analysis.

INSERT TABLE 1 ABOUT HERE

Respondents were also asked to provide a classification of the work of their responsibility centers by function. A number of choices were provided, as follows: exploration, research and development, production, manufacturing, distribution, purchasing, marketing, and administrative support; a ninth choice, "other," was also provided, with a request for a description of the work. The responsibility centers were assigned to four functional classifications, as follows: R&D, including exploration and

research and development; AS, including only administrative support; internal operations, including production, manufacturing and distribution; and boundary spanning operations, including purchasing and marketing. The responses in "other" were assigned to these four categories based on the descriptions given by the respondents.

Budget Reliance: A number of aspects of the budget and its use in the performance evaluation and reward process were measured by the questionnaire.

One question asked respondents to indicate which of the following measures are featured in their budgets and performance evaluation: (a) in physical units - inputs, outputs, outputs in relation to inputs, and (b) in monetary units - costs, revenues, profits, return on capital. They were asked to tick as many categories as were appropriate. The number of ticks was used as an indicator of measurement intensity, and the relative frequency among measures was used in the analysis of the relative reliance on physical as opposed to financial measures.

Two aspects of the budget were measured: the time period covered by the budget, and whether any alterations to the budget could be made during the progress of the operating period covered by the budget. Longer budget periods and greater adaptivity of the budget to reflect unanticipated conditions were considered possible responses to higher task uncertainty.

Two direct questions were used to assess the dominance of the budget in performance evaluation. These were based on Hopwood's (1973) notions of budget constrained and profit conscious evaluative styles. The first asked for an assessment of the importance in performance evaluation of having met budget, and the second asked for an assessment of the importance of having produced the best results possible in the

circumstances which, with hindsight, were known to have prevailed. The response to the first question, and the reverse of the response to the second question, were used as indicators of budget dominance in evaluation of performance.

An indirect method was used to assess the importance of meeting budget in the allocation of formal rewards. The method was suggested by Hirst's (1983) approach. Respondents were asked to provide an assessment of the likelihood of receiving incremental amounts of rewards - higher pay, greater bonus, and enhanced prospects of promotion - under four conditions, as follows: (1) having worked hard and imaginatively at their jobs and having met budget; (2) the same as in (1), except that budget was not met; (3) having worked at only the minimum level of effort acceptable to the organization, but having met budget; (4) the same as in (3), except that the budget was not met. The difference between the second and third subjective probabilities (having worked at the minimum acceptable level of effort but having met budget less having worked hard but having failed to meet budget) was used as a measure of the strength of the budget/reward contingency. It was so highly correlated across the three different reward elements that it was decided simply to use the numerical average of the three as a single measure.

The intercorrelations between the six aspects of budget reliance are shown in Table 2. The coefficients are not especially large, and all six were used in testing the hypotheses

INSERT TABLE 2 ABOUT HERE

RESULTS

The correlations between the aspects of budget reliance and of task uncertainty of the responsibility centers are reported in Table 3. For $H_1(a)$ to hold, we would expect to observe only negative correlations in this table. In fact, all but nine of the 66 coefficients are negative, and none of these nine is significantly different from zero. More than half the negative coefficients are significant ($p < 0.10$). All ten coefficients pertaining to the strength of the budget/reward contingency, which is perhaps the most direct indication of budget reliance, are significantly ($p<0.01$) negative. The importance in ex-post performance evaluation of having met budget is the next most significantly correlated aspect of budget reliance with task uncertainty. The aspects of task uncertainty which show the most significantly negative correlations with budget reliance are operating dynamism and unpredictability. The volatility and unpredictability of input and output prices also show significantly negative correlations with budget reliance, but not as strongly as in the case of operating dynamism and unpredictability. The reason for this, as we shall see in a moment, is that in conditions of high price volatility and unpredictability there is a tendency to use physical rather than financial measurements in the budget, filtering out the effects of price changes.

INSERT TABLE 3 ABOUT HERE

The unadjusted correlations between the aspects of budget reliance and of managers' risk and effort tolerance are shown in panel A of Table 4. $H_1(b)$ is strongly supported in the case of risk tolerance; but not in the case of effort tolerance. For risk tolerance eleven of the twelve coefficients are positive, and most are highly significant.

INSERT TABLE 4 ABOUT HERE

In summary then, H_1 is convincingly supported by the empirical evidence, with the exception that the predicted effects between effort tolerance and budget reliance are not found.

We shall return to H_1' in a moment. Proceeding first to examine H_2, the evidence pertaining to it is presented in Table 5. This shows the t-statistics for comparisons of the mean values of the frequencies of use of physical and financial measures between the portions of the sample which have relatively high and low volatility and unpredictability of input and output prices respectively. The results indicate that physical measures are more likely to be used in budgets than financial measures under conditions of higher volatility and unpredictability of input and output prices. The result is especially strong in the case of output prices, and weaker in the case of input prices, or costs; overall, however, the evidence supports accepting H_2.

INSERT TABLE 5 ABOUT HERE

Table 6 shows the correlation coefficients between aspects of task uncertainty and risk and effort tolerance. For H_3 to be supported, these coefficients should all be positive. The evidence is supportive in the case of risk tolerance but not in the case of effort tolerance. In the case of risk tolerance 15 of the 20 coefficients are in the expected direction; 12 of these 15 are significant ($p < 0.10$), whereas only one of the coefficients with the unexpected sign is significant ($p < 0.10$). Overall then, the evidence supports accepting H_3 in the case of risk tolerance, but not in the case of effort tolerance.

INSERT TABLE 6 ABOUT HERE

Returning now to H_1', the last result suggests some degree of matching of managers to the task uncertainty of roles on the basis of risk tolerance. Hence, the unadjusted correlation coefficients between aspects of budget reliance and managers' risk tolerance, as reported in panel A of Table 4, understate the direct relationship. This is so because risk tolerance and task uncertainty are positively correlated, while uncertainty and budget reliance are negatively correlated. To see the direct impact of risk tolerance on budget reliance, both have to be adjusted for the effects on them of task uncertainty. The residuals of these two variables, obtained from two multiple regressions using in each case uncertainty as the explanatory variable, were correlated, and the results are shown in panel B of Table 4. This supports H_1' for risk tolerance. The adjusted coefficients all show a stronger relationship

than the unadjusted coefficients; moreover, they are all in the expected direction and almost all are significant, ($p < 0.10$).

In view of the lack of any systematic relationship between budget reliance and effort tolerance, established in testing H_1(b), it was not considered worthwhile to test H_1' in the case of effort tolerance.

Taking up H_4, as a first step in the analysis Table 7 presents the relative frequency of use of types of budget measure across the four functional groupings. A contingency analysis was undertaken. The "expected" frequency of use of each measure was computed as if this were equal for all groupings. The actual frequency was then compared with the "expected" using a chi-squared test of significance. The reported comparison of the frequency of use of measures in one functional group is therefore relative to the frequency of use in the other three functional groups.

INSERT TABLE 7 ABOUT HERE

The internal operations functions, as was conjectured earlier in the discussion, are much more likely than the other three functional groupings to be measured in physical units. R&D is relatively frequently measured on the basis of physical output. The boundary spanning functions are significantly more frequently measured in terms of revenues and profit, and the R&D function is significantly less frequently measured in financial terms.

In panel A of Table 8 t-statistics for comparisons of the mean values are reported for each of the functional groupings for each aspect of budget reliance. Each grouping is compared in turn with the sum of the other three. R&D shows significantly lower budget reliance in all six aspects; AS also shows lower budget reliance, albeit with somewhat weaker significance than in the case of R&D. Conversely, internal operations show higher budget reliance, as do the boundary spanning functions, even though with somewhat weaker significance. These results support accepting H_4.

Table 9 shows t-statistics for comparisons of task uncertainty across the functions. It can be seen that R&D faces much greater task uncertainty than any of the other functions. This is followed in descending order of task uncertainty by the boundary spanning functions, internal operations, and finally by AS which seems to be faced by a relatively certain task environment.

INSERT TABLES 8 AND 9 ABOUT HERE

From the results supporting H_1, we know that lower budget reliance is associated with higher task uncertainty. The question therefore arises whether the differences in budget reliance observed across the functional groupings are caused simply by differences in task uncertainty. To test this, the budget reliance measures were regressed on uncertainty, and the standardized residuals were used as adjusted measures of budget reliance. The t-statistics comparing the mean values of the adjusted budget reliance measures across the groupings are reported in panel B of Table 8. It can

be seen that even after adjusting for task uncertainty there remain significant differences across the functional groupings in the degree of budget reliance. There is significantly less budget reliance in the case of R&D and considerably more in the case of internal operations. The other two groups are not so clearly differentiated. However, the differences in the strength of the budget/reward contingency across the groups is quite dramatic, and is considerably altered by the adjustment for task uncertainty. In summary, H_4' is supported by the empirical evidence.

DISCUSSION

Considering the difficulty of making reliable empirical measurements of the kinds of phenomena studied in this research, we consider that the evidence presented provides remarkably strong support of the overall proposition that organizations design their control systems in such a way as to reduce agency costs. A number of means of doing this were hypothesized, and the evidence was consistent with all of them being used in practice. First, as task uncertainty increases, budgets become more adaptable, and less reliance is placed on them in evaluating and rewarding performance. Secondly, the degree of budget reliance is modified in relation to managers' risk tolerance. Thirdly, job matching results in managers with higher risk tolerance finding their ways into those managerial roles which are characterized by higher levels of task uncertainty. Finally, higher reliance on direct monitoring of effort, and correspondingly less reliance on budget-based incentive contracts, is observed in those circumstances in which direct monitoring is likely to be feasible and cost effective, namely high geographical concentration of activities and low specificity of the production function which translates effort into effective output.

The only variable for which the evidence did not strongly support the hypothesized relationships was effort tolerance, or conversely effort aversion. This suggests that we may have poor measures of effort aversion, or that effort aversion does not play a significant role at the management level being studied. All the managers in the sample are pursuing successful careers with major U.S. corporations. It might be reasonable to suppose that such persons are unlikely to be especially effort averse; besides, when the need arises their sense of responsibility is likely to lead them to supply whatever effort is necessary to get a job done. In the case of risk tolerance, it is probably acceptable for a manager to express a preference for caution, or risk aversion, in approaching decisions, and for this to be taken into account in job assignments and in the design of incentive contracts. On the other hand, it is probably less acceptable to express a preference for avoiding work; hence, it is perhaps not surprising that we do not observe effort aversion being allowed for in the design of control strategies and in job assignments.

The hypotheses of the study were based on agency theory, but it was demonstrated that they are consistent with other theoretical perspectives on management control system design. One advantage of agency theory is that it provides a directional prediction, following from the assumptions of risk aversion and minimization of agency costs. One disadvantage, however, is that there is no obvious effectiveness correlate with the minimization of agency cost, such as managerial or organizational performance: in this sense, agency theory is quite limited. On the other hand, it is not really clear that other theoretical perspectives can provide any better predictions in this regard.

All the usual caveats must be acknowledged in respect to the study's limitations. There may, for instance, be bias in the data, arising from the means used to select a sample of managers in each company, and from self selection exercised by managers themselves in choosing whether to respond to the questionnaire; and despite careful pre-testing and the use of consistency checks across responses, respondents may not have interpreted questions in precisely the intended manner . Moreover, the findings may not be generalizable beyond the companies included in the research. However, since managers from 13 major companies in a wide variety of industries were included in the sample, we feel that the results have á reasonably strong claim to being representative of large U.S. corporate organizations. However, the findings may not be generalizable to other levels of management. Our judgment on this is that the findings are likely to apply to lower levels of management; however, given the need to cope effectively with environmental uncertainty in devising and implementing business strategies, the findings are less likely to hold at general management levels.

A number of exciting avenues for further research suggest themselves. For example, the differences observed in control strategies across functions would bear considerably closer examination, with a view to determining the characteristics of control systems most suitable for each of the functions. Another interesting question, as suggested in the previous paragraph, is whether the reduction of agency costs is observed in the control strategies used at higher levels of management. If it were, an intriguing question would follow, concerning the point at which, and how, goal congruence is established between managers and the interests of shareholders.

Appendix 1

Let the output of a production process be x. Suppose:

$$x = Q(a) - \tilde{e}$$

Where Q(a) is an increasing concave function, a is the effort supplied by the agent, and $\tilde{e}$ is a random variable with normal distribution, zero mean, and variance s^2.

Suppose the agent is risk averse, with a mean variance utility function for reward r equal to Exp(r)-kVar(r), where Exp and Var refer to the expected value and the variance respectively. The constant k is a risk aversion parameter, specific to the manager, where $k \geq 0$. The principal is assumed to be risk neutral. Suppose further the agent is effort averse, where the disutility of effort a is tV(a). Here t is an effort aversion parameter, specific to the manager, where $t \geq 0$. V(a) is an increasing convex function in a.

Assume that all agents have the same Q and V functions, but differ with regard to risk and effort aversion, i.e. with regard to k and t. Let us also assume that only linear reward schemes are used. Let the reward associated with output x be:

$$r(x) = F + bx$$

Where F is a fixed wage and b is a bonus rate based on the output x.

Suppose the agent chooses effort a. His expected utility will be:

$$EU = F + bQ(a) - kb^2s^2 - tV(a) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In this case, the optimal effort is given by:

$$bQ'(a) = tV'(a)$$

Suppose the principal wants the agent to supply a level of effort $\bar{a}$. He should set $b = tV'(\bar{a})/Q'(\bar{a})$. Assuming the agent must get at least zero expected utility, from (1):

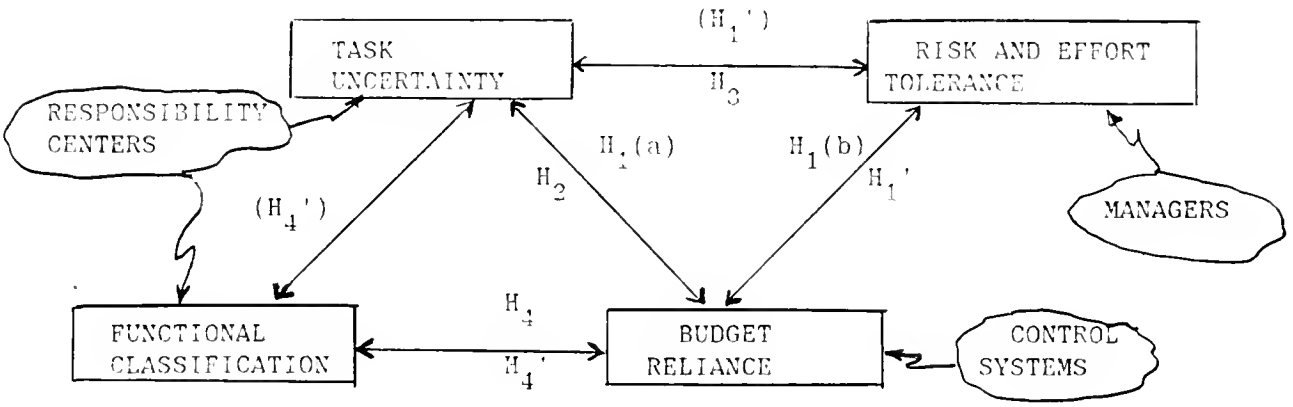
$$F = tV(\bar{a}) + kb^2s^2 - bQ(\bar{a}) \quad \ldots\ldots(2)$$

The principal receives Exp(x-F-bx). Substituting for F an b, the principal's benefit from any level of effort is:

$$G(a) = Q(a) - tV(a) - kt^2s^2[V'(a)/Q'(a)] \quad \ldots\ldots(3)$$

The last term in equation (3) is termed the agency cost. If t = 0 the agency cost is zero, and the effort will be supplied costlessly. If k or s^2 are zero, the agency cost will also be zero and the first-best solution will be restored. The agency cost will increase as t and k increase, the effort and risk aversion parameters of the agent, and as the variance s^2 increases, the degree of randomness of the production process. This last term is equated with task uncertainty in this paper.

FIGURE 1: Summary of the Research Framework and Hypotheses



H_1: Lower budget reliance is expected to be associated with: (a) responsibility centers with greater task uncertainty; (b) managers with lower risk and effort tolerances (Tables 3 and 4).

H_1': Even after controlling for differences in the task uncertainty of responsibility centers, less budget reliance is expected to be associated with managers with lower risk and effort tolerances (Table 4).

H_2: Greater frequency and lower predictability of change in input and output prices are expected to be associated with a greater propensity to use physical, instead of financial, measurements in the budget (Table 5).

H_3: Managers with greater risk and effort tolerances are expected to be associated with responsiblity centers with greater task uncertainty (Table 6).

H_4: Greater budget reliance is expected to be associated with internal operations, purchasing and sales functions than with research and development and administrative support functions (Tables 7 and 8).

H_4': Even after controlling for differences in task uncertainty, greater budget reliance is expected to be associated with internal operations, purchasing and sales functions than with research and development and administrative support functions (Tables 8 and 9).

Notes: (a) The letters next to the arrows between the variables in the diagram denote the hypotheses which refer to the particular relationship.

(b) The tables noted at the end of each of the hypotheses contain the relevant data analysis.

Table 1

First order correlation coefficients between aspects of task uncertainty

	1	2	3	4	5	6	7	8	9	10
1. Input price volatility										
2 Input price unpredictability	0.766									
3. Output price volatility	0.366	0.356								
4. Output price unpredictability	0.294	0.348	0.752							
5. Operating dynamism	0.200	0.203	0.073	0.065						
6. Operating unpredictability	0.179	0.212	0.069	0.120	0.445					
7. Workflow interruptions	0.077	0.101	0.036	0.037	0.214	0.124				
8. Workflow unpredictability	0.048	0 065	0.015	0.037	0.089	0.158	0.225			
9. Nonstandardization of work	0.192	0.250	0.185	0.148	0.177	0.231	0.216	0.144		
10. Dependence on other units	-0.080	-0.115	0.030	0.057	0.115	0.119	0.097	0.023	0.031	
11. Dependendence of other units	-0.009	-0.005	0.030	0.001	0.046	0.032	0.151	0.008	0.016	0.458

Table 2

First order correlation coefficients between aspects of budget reliance

	Measure-ment inten-sity	Shor-ter budget period	Lower budget adap-tivity	Impor-tance of meeting budget	Disre-gard for best results
Shorter budget period	0.027				
Lower budget adaptivity	0.094	0.200			
Importance of meeting budget	0.163	0.082	0.244		
Disregard for best results	0.024	0.089	0.172	0.154	
Budget reward contingency	0.092	0.185	0.088	0.179	0.092

Table 3

First order correlation coefficients between aspects of budget reliance and task uncertainty

Aspects of task uncertainty \ Aspects of budget reliance	Measurement intensity	Shorter budget period	Lower budget adaptivity	Importance of meeting budget	Disregard for best results	Budget reward contingency
1. Input price volatility	.078	-.088$_{1}$	-.117^{2}	-.143^{3}	-.092^{1}	-.218^{3}
2. Input price unpredictab.	.058	-.092^{1}	-.090	-.177^{3}	-.105^{1}	-.354^{3}
3. Output price volatility	.081	-.055	-.075	-.046$_{2}$	.036	-.283^{3}
4. Output price unpredictab.	-.023	-.061$_{3}$	-.057$_{2}$	-.139^{2}	.028$_{2}$	-.322^{3}
5. Operating dynamism	.013	-.145^{3}	-.137^{2}	-.134^{2}	-.120^{2}	-.432^{3}
6. Operating unpredictability	-.023$_{2}$	-.205^{3}	-.184^{3}	-.239^{3}	-.125^{2}	-.345^{3}
7. Workflow interruptions	-.113^{2}	-.013	-.032	-.105^{1}	-.027	-.282^{3}
8. Workflow unpredictability	-.028	-.072$_{1}$	.003$_{2}$	-.121^{2}	-.019	-.261^{3}
9. Nonstandardization of work	-.048	-.100^{1}	-.119^{2}	-.172^{3}	-.057	-.195^{3}
10. Dependence on other units	-.028	-.058	.004	-.091	-.023	-.252^{3}
11. Dependence of other units	-.093	-.086	.044	-.096	-.036	-.257^{3}

1: $p < 0.10$; 2: $p < 0.05$; 3: $p < 0.01$.

Table 4

First order correlation coefficients between aspects of budget reliance and risk and effort tolerance

Aspects of risk and effort tolerance \ Aspects of budget reliance	Measurement intensity	Shorter budget period	Lower budget adaptivity	Importance of meeting budget	Disregard for best results	Budget reward contingency
A. Risk tolerance						
Entrepreneurial style	.381[3]	.079	.312[3]	.175[3]	.163[3]	.100[1]
High risk/return preference	.292[3]	-.030	.156[3]	.171[3]	.112[2]	.071
A. Effort tolerance						
Hours	.042	-.014	-.042	.099	-.067	.032
Intensity	.101[1]	-.025	-.014	.082	-.088	.064
B. After adjusting for uncertainty						
Entrepreneurial style	.382[3]	.104[1]	.346[3]	.217[3]	.193[3]	.168[3]
High risk/return preference	.298[3]	.015	.220[3]	.235[3]	.150[3]	.150[3]

1: $p < 0.10$; 2: $p < 0.05$; 3: $p < 0.01$

Table 5

Mean differences in price uncertaintyand physical versus monetary budget measurement; T-statistics

	Physical units	Monetary units
Input prices:		
Volatility	2.20[2]	-1.05
Unpredictability	1.682	-0.62
Output prices:		
Volatility	3.43[3]	-1.29[1]
Unpredictability	2.37[3]	-1.91[2]

1: $p < 0.10$; 2: $p < 0.05$; 3: $p < 0.01$ that the mean for that measure is significantly different from the mean for the other measures.

Table 6

First order correlation coefficients between aspects of task uncertainty and risk and effort tolerance

Task uncertainty:	Risk tolerance		Effort tolerance	
	Entrepreneurial style	Risk/return preference	Hours of work	Intensity of effort
1. Input price volatility	.127[2]	.221[3]	.006	.040
2. Input price unpredictab.	.168[3]	.201[3]	.014	.064
3. Output price volatility	.163[2]	.159[2]	-.018	-.034
4. Output price unpredictab.	.106[1]	.116[2]	-.100[1]	-.066
5. Operating dynamism	.027	.144[3]	.091	.116[2]
6. Operating unpredictability	.091	.136[2]	-.025	-.024
7. Workflow interruptions	-.005	.047	-.012	.040
8. Workflow unpredictability	-.019	-.059	-.018	-.022
9. Nonstandardization of work	.141[2]	.177[3]	-.012	-.029
10. Dependence on other units	-.068	.112[2]	-.139[2]	-.109[1]
11. Dependence of other units	-.082	-.097	-.041	-.007

1: $p < 0.10$; 2: $p < 0.05$; 3: $p < 0.01$

Table 7

Budget measurement and functions

Functions:	Internal operations	Sales & purchasing	Administrative support	Research & development	Total
Physical units:					
Inputs	37^{-++} 23.4	19 20.1	33 38.9	18 23.1	107
Outputs	59^{--} 49.1	39 49.2	68^{---} 81.8	57^{++} 48.4	224
Outputs/inputs	48^{-++} 32	23 27.6	46 53.4	30 31.5	146
Monetary units:					
Costs	85 80.2	64^{-} 69	138 133.4	76 78.6	364
Revenues	19^{---} 29.4	47^{++-} 25.3	54 48.9	16^{---} 29.2	135
Profits/ contribution	35 39.4	57^{++-} 33.9	64 65.7	28^{---} 39.7	184
Return on Investment	25 24.5	23 20.6	39 40	22 23.5	109
Totals	93	80	155	92	

Each cell shows the actual frequency with the 'expected' frequency beneath it. Significantly higher(lower) than expected frequencies are denoted by +-+,-+ and + (---,-- and -) for a chi-squared comparison for $p < 0.01$, $p < 0.05$ and $p < 0.1$ respectively.

Table 8

Mean differences in aspects of budget reliance across functions; T-statistics

Functions: \ Aspects of budget reliance	Measurement intensity	Shorter budget period	Lower budget adaptivity	Importance of meeting budget	Disregard for best results	Budget reward contingency
A. Internal operations	2.31^{2}	2.36	3.81^{3}	3.28^{3}	0.65	5.35^{3}
Sales & purchasing	2.77^{3}	0.26	-0.81	0.42	-0.34	5.39^{3}
Administrative support	-1.36^{1}	-0.24	1.10	-0.64	0.55	-3.52^{3}
Research & development	-2.33^{2}	-3.53^{3}	-4.63^{3}	-2.96^{3}	-1.53^{1}	-4.61^{3}
B. After adjusting for uncertainty						
Internal operations	1.78^{2}	2.42^{3}	3.05^{3}	2.90^{3}	-0.21	4.53^{3}
Sales & purchasing	2.16^{2}	0.49	-0.32	0.56	0.14	6.03^{3}
Administrative support	-0.76	-0.30	0.96	-0.36	1.17	-4.79^{3}
Research & development	-1.99^{2}	-2.39^{3}	-3.47^{3}	-2.43^{3}	-1.54^{1}	-3.22^{3}

1: $p < 0.10$; 2: $p < 0.05$; 3: $p < 0.01$ that the mean for the function is significantly different relative to the mean for the other functions.

Table 9

Mean differences in aspects of task uncertainty
across functions; T-statistics

Task uncertainty: \ Functions:	Internal operations	Sales & purchasing	Administrative support	Research & development
1. Input price volatility	-0.38	2.45[3]	-2.14[1]	0.55[2]
2. Input price unpredictab.	-1.17	1.15	-1.48[1]	1.80[2]
3. Output price volatility	0.20	-0.81	-2.16[2]	2.95[3]
4. Output price unpredictab.	-0.87[2]	-0.44	-2.24[2]	3.91[3]
5. Operating dynamism	-2.23[2]	1.61[1]	1.10	0.29
6. Operating unpredictability	-1.17[2]	-0.28	1.07	0.56
7. Workflow interruptions	-0.10[2]	0.18[1]	-0.29	1.63
8. Workflow unpredictability	0.85[3]	-1.59[1]	-0.06	1.00[3]
9. Nonstandardization of work	-4.08[3]	0.34	0.27	3.23[3]
10. Dependence on other units	0.04	-1.11	-0.13[2]	-0.37[2]
11. Dependence of other units	0.86	-0.53	-2.45[2]	2.22[2]

1: $p < 0.10$; 2: $p < 0.05$; 3: $p < 0.01$ that the mean for the function is significantly different relative to the mean for the other functions.

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